

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A calibration method in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions; a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the method comprising the steps of:

providing a reference mark at a stationary position on the base frame to reside in the visual field of the component recognizing camera;

positioning the movable table to a predetermined position relative to a coordinate origin to make the reference mark at the stationary position come in the visual field of the board recognizing camera; and

calculating a positional relation between optical axes of the board recognizing camera and the component recognizing camera when the movable table is positioned at the predetermined position, based on respective positional relations of the reference mark, at the stationary position, relative to the optical axes of the component recognizing camera and the board recognizing camera, the respective positional relations being detected by the component recognizing camera and the board recognizing camera.

Claim 2 (Currently Amended): A calibration method in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions; a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the method comprising the steps of:

providing a reference mark on the base frame to reside in the visual field of the component recognizing camera;

positioning the movable table to make the reference mark come in the visual ~~field~~ field of the board recognizing camera and at the same time, to make the end of a component pick-up portion of the component placing device come in the visual field of the component recognizing camera; and

calculating a positional relation between the board recognizing camera and a center line of the component pick-up portion based on the following positional relations (1) and (2):

(1) a positional relation between an optical axis of the board recognizing camera and the reference mark which relation is detected by the board recognizing camera, and

(2) positional relations of the reference mark and the center line of the component pick-up portion relative to an optical axis of the component recognizing camera which relations are detected by the component recognizing camera.

Claim 3 (Currently Amended): A calibration method in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions; a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the method comprising the steps of:

providing the base frame with first and second reference marks of a predetermined positional relation with the first reference mark residing in the visual field of the component recognizing camera;

positioning the movable table to make the second reference mark come in the visual ~~field~~ field of the board recognizing camera and at the same time, to make the end of a component pick-up portion of the component placing device come in the visual field of the component recognizing camera; and

calculating a positional relation between the optical axis of the board recognizing camera and a center line of the component pick-up portion based on the following positional relations (1)-(3):

(1) a positional relation between the optical axis of the board recognizing camera and the second reference mark which relation is detected by the board recognizing camera,

(2) positional relations of the first reference mark and the center line of the component pick-up portion relative to an optical axis of the component recognizing camera which relations are detected by the component recognizing camera, and

(3) the positional relation between the first and second reference marks.

Claim 4 (Original): A calibration method in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the method comprising:

a first step of providing a reference mark on the base frame to reside in the visual field of the component recognizing camera;

a second step of positioning the movable table to a first position to make the reference mark come in the visual field of the board recognizing camera and detecting respective positional relations of the reference mark relative to optical axes of the component recognizing camera and the board recognizing camera by the use of these cameras;

a third step of positioning the movable table to a second position to make the end of a component pick-up portion of the component placing device come in the visual field of the component recognizing camera and detecting a positional relation between the optical axis of the component recognizing camera and a center line of the component pick-up portion by the use of the component recognizing camera, one of the second and third steps being performed prior to the other; and

calculating a positional relation between the optical axis of the board recognizing camera and the center line of the component pick-up portion based on the following positional relations (1)-(3):

(1) the positional relation between the axes of the board recognizing camera and the component recognizing camera detected with the movable table being positioned at the first position;

(2) the positional relation between the optical axis of the component recognizing camera and the center line of the component pick-up portion detected with the movable table being positioned at the second position; and

(3) a positional relation between the first and second positions.

Claims 5-9 (Cancelled).

Claim 10 (Currently Amended): A calibration device in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions; a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the calibration device including:

a reference mark provided at a stationary position on the base frame to come in the visual fields of the component recognizing camera and the board recognizing camera when

the movable table is positioned at a predetermined position relative to a coordinate origin of the electronic component mounting apparatus; and

calculation means for calculating a positional relation between optical axes of the board recognizing camera and the component recognizing camera when the movable table is positioned at the predetermined position, based on respective positional relations of the reference mark, at the stationary position, relative to the optical axes of the component recognizing camera and the board recognizing camera, the respective positional relations being detected by the component recognizing camera and the board recognizing camera.

Claim 11 (Original): A calibration device in an electronic component mounting apparatus having a circuit board transfer device mounted on a base frame for performing the loading, unloading and positioning of circuit boards; a movable table supported on the base frame to be movable in two directions of X and Y directions; a component placing device installed on the movable table for taking out components supplied by a component supply device and mounting the components on the circuit board positioned on the circuit board transfer device; a board recognizing camera fixed on the movable table; and a component recognizing camera fixed on the base frame; wherein the component placing device is replaceable with another component placing device different in performance, the calibration device including:

first and second reference marks provided on the base frame in a predetermined positional relation so that when the movable table is positioned to a predetermined position to make the end of a component pick-up portion of the component placing device come in the visual field of the component recognizing camera, the first reference mark comes in the visual field of the component recognizing camera, while the second reference mark comes in the visual field of the board recognizing camera; and

calculation means for calculating a positional relation between the optical axis of the board recognizing camera and a center line of the component pick-up portion based on the following positional relations (1)-(3):

(1) a positional relation between the optical axis of the board recognizing camera and the second reference mark which relation is detected by the board recognizing camera,

(2) positional relations of the first reference mark and the center line of the component pick-up portion relative to an optical axis of the component recognizing camera which relations are detected by the component recognizing camera, and

(3) the positional relation between the first and second reference marks.

Claim 12 (Original): The calibration device as set forth in claim 11, wherein the first and second reference marks are provided on a reference gauge, and wherein the reference gauge is detachably set on a support member secured to the base frame.